Preparation for the study of gene expression aboard the International Space Station

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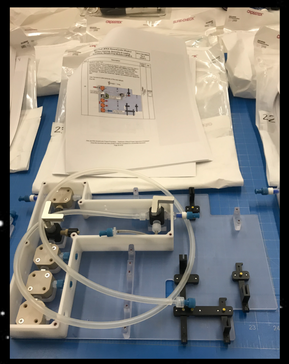
Background

WetLab-2 performs quantitative polymerase chain reaction (qPCR) aboard the micro-gravity environment of the International Space Station. The WetLab-2 facility includes a commercial qPCR instrument (RNA SmartCycler), a sample transfer tool, and a set of fluidic modules. The fluidic modules include the sample prep module (SPM), the pipette loader, and pre-loaded PCR reaction tubes. In order to prepare the SPMs for flight, preparation and kitting of the hardware must be performed in the Clean Room. In May 2019, SpaceX-18 will bring all the WetLab-2 flight hardware to the International Space Station where the experiment will be carried out by the astronauts.

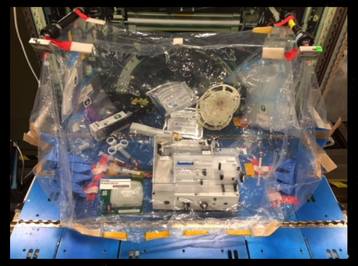
Working in the Clean Room



SPM in the Clean Room

Important Constraint

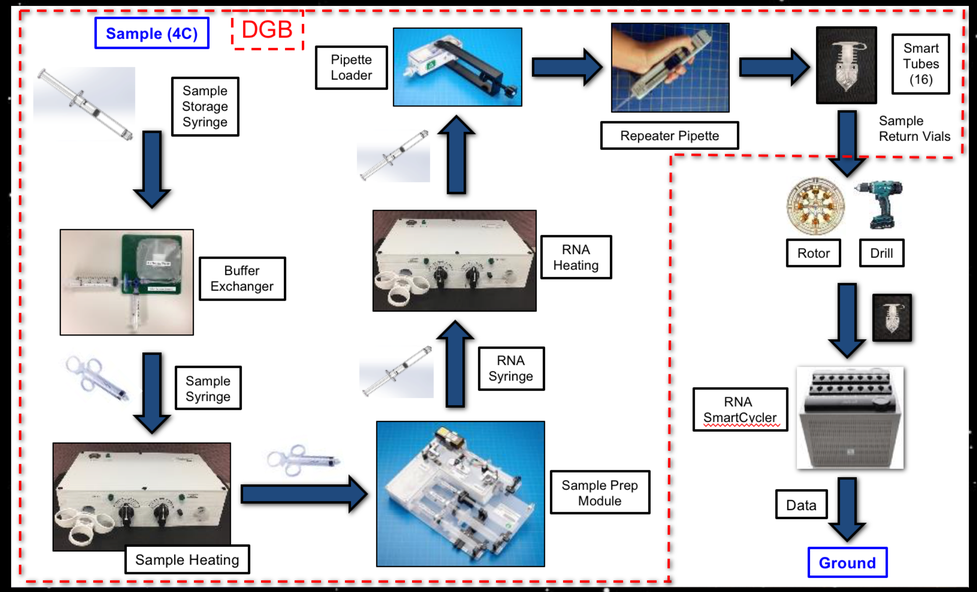
Astronauts are required to do each experiment in a Disposable Glove Bag. The DGB eliminates contaminates from reaching the sample and prevents contaminates from escaping to the ISS.



Disposable Glove Bag

Procedure Flow Chart

1. Take Sample Storage Syringe and put it in the Buffer Exchanger to swap buffer type. **2.** Take the Sample Syringe and place it in the Syringe Heater to heat reagent to desired temperature. **3.** Take the Sample Syringe and expel the sample into the SPM to lyse the cells and extract RNA. **4.** Take the RNA Sample Syringe and put it into the Syringe Heater. **5.** Put the heated syringe into the Pipette Loader to remove bubbles from extracted RNA. **6.** Use Repeater Pipette to load the Smart Tubes that contain freeze-dried reagents to mix with the RNA. **7.** Load the rotor and use the drill to spin the rotor, centrifuging the mixture. **8.** Place the Smart Tubes into the RNA SmartCycler to provide a Quantitative Real-Time PCR, potentially targeting 4 genes in each of the 16 tubes. **9.** Send data.



Acknowledgements

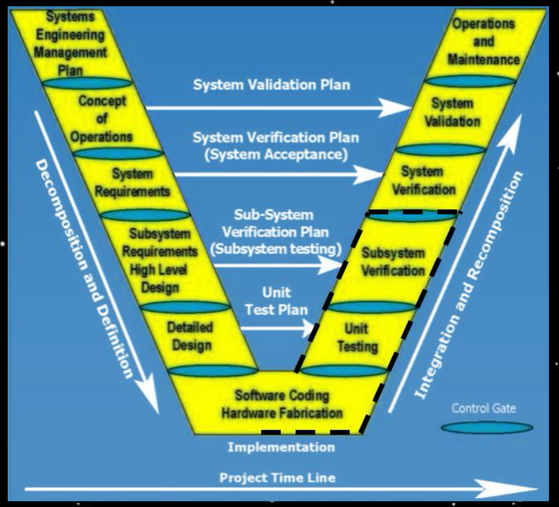
The 2018 STEM Teacher and Researcher Program and this project have been made possible through support from Chevron (www.chevron.com), the National Marine Sanctuary Foundation (www.marinesanctuary.org), the National Science Foundation through the Robert Noyce Program under Grant #1836335 and 1340110, the California State University Office of the Chancellor, and California Polytechnic State University in partnership with NASA Ames. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the funders. Special thanks to Mark Mallinson, Tori Chinn, Rudy Aquilina, Travis Boone, Tim Snyder and the STAR Teacher Researcher Program.

Overall Objectives

- Enable on-board space biology gene expression research as well as analysis of environmental contaminants
- Provide sample preparation and analysis capability

Engineering Goal and Objectives

- Prepare all sample prep modules (SPMs) for SpaceX-18
- Integrate and kit flight hardware
- Audit documentation packages
- Aid in hardware fabrication and unit testing for the project



Engineering V-Chart

The engineering protocol for the WetLab-2 project can be expressed by means of a V-chart which divides the project into milestones. This summer, interns are aiding in hardware fabrication and unit testing for the project. This includes leading SPM builds, rotor kitting, and developing procedures for tests. This allows interns to improve communication and leadership skills. By facilitating builds and developing procedures, interns can approach the internship from all aspects, which ultimately allows them to have a deeper understanding of the objectives and processes of the project.